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## IMMATURE STAGES OF INDIAN LEPIDOPTERA (COSSIDAE, INDARBELIDAE).

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(With a plate)

The families *Indarbelidae* and *Cossidae* contain species the larvae of which attack the living stems of numerous valuable species of trees and are therefore of great economic importance. A means of identifying larvae is particularly desirable since rearing to the adult stage is difficult and also because nearly all requests for advice on control measures are accompanied by preserved larvae only.

In the following key to mature larvae, the *Hepialidae* (represented by *Phassus* spp.) are mentioned since their larvae superficially resemble those of *Indarbelidae* and have similar feeding habits, that is to say, they feed mainly on the soft external tissues of the stem under a camouflage of frass and silk, with a deeper

tunnel for refuge. The *Cossidae* on the other hand feed internally on the sapwood.

In all three families the prespiracular setae on T<sub>1</sub>\* are three in number, indicating affinity with the Microlepidoptera.

#### KEY TO FAMILIES.

1. The dorsal plate of T<sub>1</sub> is continued downward on each side in front of spiracle and bears the 3 prespiracular setae. Crochets of ventral prolegs biserial, that is, with an outer ellipse of small crochets in addition to the main ellipse ... .. *Hepialidae*.  
The 3 prespiracular setae of T<sub>1</sub> isolated from the dorsal shield. Crochets uniserial, with no outer row. (2).
2. Head smooth, partly retracted into prothorax. Ocelli 1 to 4 in a nearly evenly spaced semicircle. Setae I and II not all on a common dorsal plate on anterior abdominal segments. (Pronotum asperate or not) ... .. *Cossidae*.  
Head rugulose, not overlapped by prothorax. A wide gap between ocelli 2 and 3. The four setae I and II borne together on a dorsal plate. (Pronotum smooth) ... .. *Indarbelidae*.

#### Larvae of *Cossidae*.

*Family characters*.—Head rather small, partly embedded in prothoracic skin, nearly horizontal. Ocelli six on each side, the upper four in a semicircle, about equally spaced. Frons distinctly higher than wide. Adfrontal area rather narrow. Labrum with at most a trace of anterior emargination. Prothorax with three prespiracular setae which are separate from the well sclerotized dorsal shield. Mesothorax and metathorax with setae I and II one above the other, and with only one seta (VI) above the legs. Abdomen with seta I well anterior to, and more dorsal than seta II on anterior segments; setae IV and V approximate below spiracles. Head and body without secondary setae. With five pairs of short and stout prolegs, four ventral, one anal; crochets in an ellipse on ventral prolegs (transverse bands in *Cossula*, an American genus). Borers in living wood or in reeds (*Phragmatoecia*).

Seta IIIa anterior to spiracle. Small additional setae may be present near the anterior margins of the segments. The setae may be borne on small plates (pinacula) but these are isolated and not as extensive as in the *Indarbelidae*, except dorsally on prothorax, A<sub>9</sub> and A<sub>10</sub>. The body is on the whole rather soft, less cylindrical than in *Indarbelidae*. Spiracles oval, small; apparently non-functional spiracles are present on T<sub>2</sub> and T<sub>3</sub>.

#### Key to Genera.

1. Pronotum smooth. Seta III on A<sub>8</sub> directly above the spiracle (*Cossinae*) ... .. *Cossus*.  
Pronotum asperate posteriorly. Seta III on A<sub>8</sub> either directly anterior to the spiracle or higher and slightly anterior (*Zeuserinae*) ... .. (2).

\* The thoracic and abdominal segment are referred to as T<sub>1</sub> to T<sub>3</sub> and A<sub>1</sub> to A<sub>10</sub> respectively.

2. The asperities on pronotum coarse and prominent, especially in the anterior rows. Crochets biordinal or triordinal ... .. (3).  
 Pronotal asperities small, more granular, but there is an anterior row of four widely spaced transverse ridges, which, although fairly large are only slightly raised. Crochets uniordinal ... .. *Azygophleps*.
3. Not more than the posterior third of pronotum is asperate. Spiracle of A8 at least 1.5 times as large as that of A7, which is distinctly larger than that of A6. *Zeuzera*.  
 One half, or nearly half the pronotum is asperate. Spiracle of A8 less than 1.5 times as large as spiracle A7 which is subequal to spiracle A6 in mature larvae *Xyleutes*.

### Cossus F.

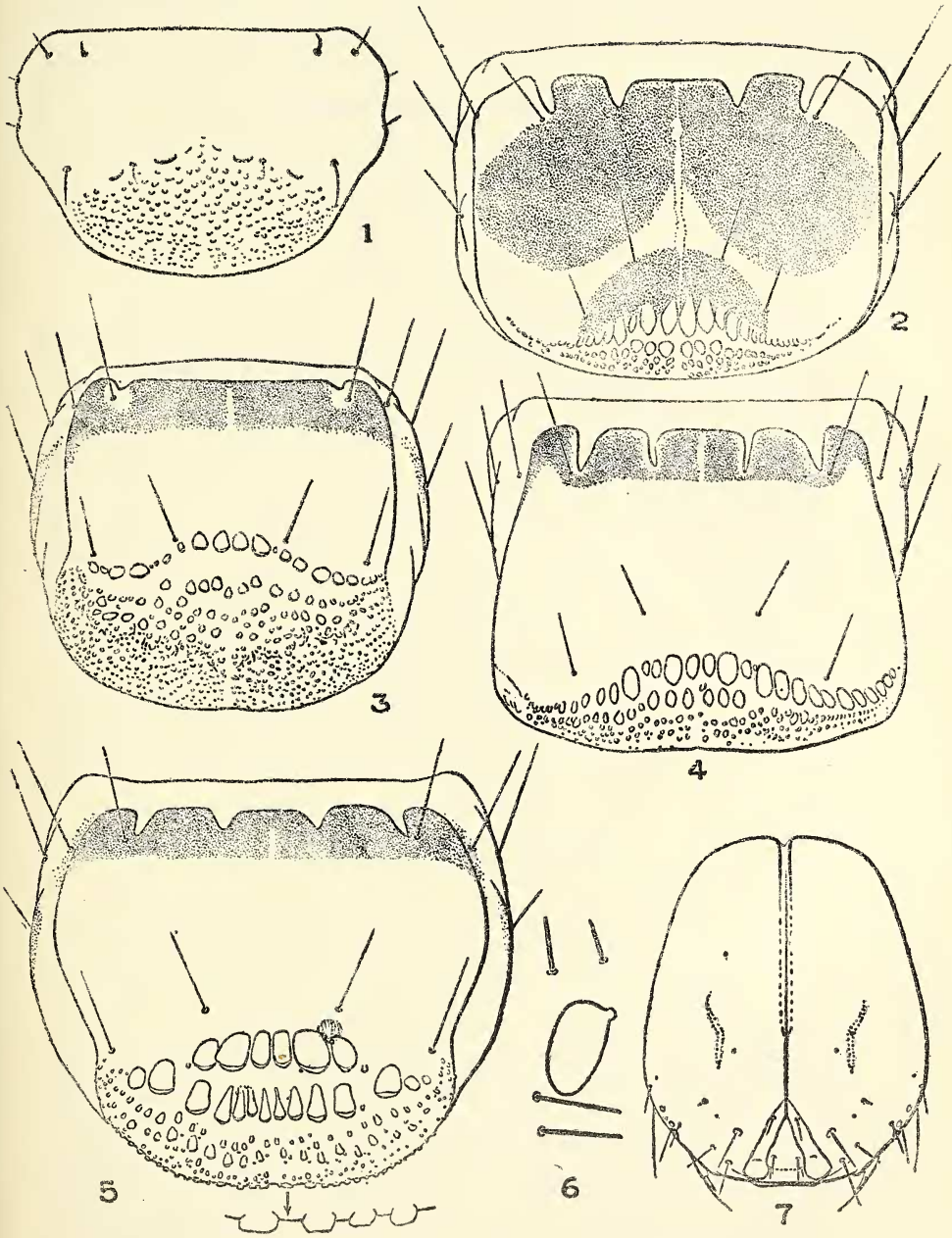
*Larval characters*.—Head slightly wider than long, with a deep posterior emargination (visible in dorsal view) which is continued anteriorly as a deep groove to not far from the middle of the head. The adfrontal sutures meet the apex of this groove. The frons nearly one-third as long as the head, and longer than the distance between its apex and the posterior groove. The prothoracic plate smooth, transverse, its lateral margins horizontal and near spiracles. Seta III of A8 above the spiracle. Setae II of A9 closer together than Setae I and also closer than Setae II of the preceding segments. Spiracle of A8 not enlarged, at the same level as the preceding spiracles. Crochets biordinal (or partly triordinal) in complete ellipse on ventral prolegs.

*Cossus cadambae* Moore has the head pale brown, pronotum testaceous, the setae not borne on pigmented plates. The spiracles large. The crochets triordinal in part. Three larvae, about .40 mm. long from *Tectona grandis*, Travancore.

*Cossus acronyctoides* Moore resembles the former except that the spiracles are very small. One larva, length 25 mm., from *Tamarix articulata*, Punjab.

### *Azygophleps scalaris* F.

*Larva* (fig. 1).—Head about as wide as long, the posterior emargination rather narrow and about one-third length of head. Frons nearly one-third length of head, convex. Adfrontal sutures not quite reaching apex of posterior sinus. Prothoracic shield with a little more than the posterior half asperate; the asperities small, granular, irregularly arranged and more or less equal in size except for a posterior group of smaller asperities; anterior to this convex patch is a widely spaced row of four large, but weakly raised, transverse carinae. Spiracles large; that of A8 slightly larger than that of A7 and above the level of the preceding spiracles. Crochets of ventral prolegs uniordinal, in an ellipse. Seta III of A8 anterior to spiracle but well above it. Body setae inconspicuous. Some of the middle body segments somewhat raised dorsally forming weak 'ambulatory ampullae'. Length about 28 mm.



J. C. M. Gardner—Larvae of Cossidae.  
*For explanation see end of article.*



Described from two larvae lent by the Imperial Agricultural Entomologist, New Delhi: one from stem of *Sesbania grandiflora*, Madras; the other from *Sesbania* sp., Orissa.

The larva is figured by Fletcher, 1918, *Rep. Imperial Entomologist*, pl. 16, fig. 2.

### *Phragmatoecia castaneae* Hubn.

I have not seen larvae of this species which also occurs in Europe as a borer of reeds. The pronotum is asperate (Buckler), the last pair of spiracles enlarged and more dorsally placed and the crochets uniordinal and in a complete ellipse (Fracker).

### *Zeuzera latreille*

*Larval characters* (figs. 2, 4, 6, 7).—Head much larger than wide, somewhat narrowly rounded posteriorly with at most a shallow emargination visible from above. Frons very small, about one-sixth as long as the head. Adfrons extending a short way beyond frons and distant from attachment of prothorax. Prothoracic shield strong, the lateral margins well above spiracles; not more than the posterior third asperate; the asperities in middle of anterior row coarse, longer than wide. A<sub>9</sub> with a transverse plate bearing the dorsal setae. The other body setae on more or less circular isolated plates. Seta III of A<sub>8</sub> anterior to the spiracle. Spiracle of A<sub>8</sub> one and a half times or more larger than that of A<sub>7</sub> and at a higher level; spiracle A<sub>7</sub> larger than spiracle A<sub>6</sub>. Crochets biordinal (or triordinal in part), in a complete ellipse.

The elongate oval head has some resemblance to certain larvae of Lamiinae. However the figure of *Z. pyrina* from Europe, given by Frackler (1915, fig. 72) shows a transverse head with a strong posterior emargination which suggests that that species may not be really congeneric with Indian species of *Zeuzera*.

### KEY TO SPECIES.

1. The inner two of the four middle asperities of the anterior row on pronotum distinctly smaller than the other two ... .. (2).  
The four middle asperities of the anterior row all of about the same size ... .. *Z. coffeae*.
2. The posterior spiracle with a small lip or angulation on the upper margin ... .. *Z. multistrigata*.  
Peritreme of posterior spiracle even, without a lip. ... .. *Z. indica*.

*Zeuzera coffeae* Nietner (figs. 2, 6, 7).—Head mostly testaceous; pronotum with dark brown anterior patches and dark asperities posteriorly, otherwise testaceous; body pink, the dorsal plates of A<sub>9</sub>, A<sub>10</sub> pale brown. The asperities on pronotum as in figure 2, an antero-median row of four, large and equal and a small one on each side, continued laterally where they become minute; a second row of six moderate asperities; the remainder very small. The last posterior spiracle has a distinct lip dorsally (fig. 6). Length about 40 mm. The larva attacks numerous living trees, including *Tectona grandis* and *Santalum album* and is a pest on tea and coffee.

*Z. multistrigata* Moore (fig. 4).—The anterior row of asperities continued laterally and slightly backwards as in *coffea*, but the middle two teeth are much smaller than the two on either side. The setal plates more deeply pigmented than in *coffea*. The posterior spiracle with a lip or angulation of upper margin. Length about 65 mm. In small larvae (up to 17 mm.) the body is dark red, the head pronotum and dorsal plates on A9 and A10 black. In larger larvae these parts are smoky testaceous. Described from larvae extracted from *Cryptomeria japonica*, Darjeeling (J.C.M.G., 1923). These larvae, and those of Hepialids, were doing considerable damage in young plantations. Larvae sent me by the Entomologist, Fruit Research Station, Chaubattia, from apple trees, are identical.

*Z. indica* H. Schaffer.—The anterior row of asperities on pronotum very much as in *multistrigata* (two small in the middle, between two larger ones, and then a small one on each side) but the middle ones are rather more out of line with (more anterior than) the lateral row. The tergal plates and setal plates brownish. The posterior spiracle with no lip. Length about 60 mm.

Described from one larva from *Litsea polyantha*, Dehra Dun; moths were reared and later identified by Mr. G. E. Bryant. Another larva taken from the root of *Miliusa velutina*, Bhamo, Burma, appears to be identical; however, I have no record of the moth of this species from Burma.

### Xyleutes Hubner.

*Larval characters*.—Very much as in *Zeuzera*, but the asperate patch on pronotum more extensive, covering distinctly more than the posterior third; the coarse anterior asperities more transverse. The head longer than wide, narrowed behind the middle; with a narrow posterior cleft which is almost closed in *persona*. Seta III of A8 anterior to spiracle and not above its level. Spiracle of A8 about 1.3 times larger than that of A7 which is subequal to that of A6. Mature larvae larger than *Zeuzera*. Borers in living wood. In small larvae (length about 25 mm.) the spiracle of A8 is much larger than that of A7 and is actually nearly as large as in the mature larva.

*Xyleutes ceramica* Walker is the notorious Beehole Borer of teak in Burma and the larval instars have been described in some detail by Beeson (1921). The head moderately elongate, the frons about one-third as long; the posterior margin with a narrow posterior cleft and groove. The pronotal asperities (fig. 3) extend to the middle of the shield, as far as the posterior paramedian setae; the posterior asperities small, more granular, numerous, the last row not widened. Setae I on A9 well anterior to setae II and only slightly more separated. The posterior spiracle larger than that of A7 and above its level; the peritreme evenly oval with no 'lip'. Setae of middle segments on at most very small plates. Length up to 62 mm.

*Xyleutes leuconota* Walker differs from *ceramica* as follows: Frons about one-fourth as long as head, which is more elongate, the posterior cleft of head narrower. The patch of asperities on